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INSTITUTE OF GAS TECHNOLOGY

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CHICAGO 16, ILLINOIS

GAS ABSTRACTS

VOLUME 6, NUMBER 4

APRIL, 1950

AFFILIATED WITH

ILLINOIS INSTITUTE OF TECHNOLOGY

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GAS ABSTRACTS is published and distributed monthly by the Institute of Gas Technology, Chicago 16, Illinois. The contents of selected papers and patents are reviewed impartially by the editorial staff and material of potential interest to the Gas Industry is presented. Subscription rates to non-members of the Institute: $15.00 per year.—Printed in the U.S.A.

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1. GAS INDUSTRY

Appliances

Springborn, H. W. GAS APPLIANCE MANUFACTURERS SPEARHEAD EXCISE TAX REPEAL. *Gas Age* **105**, 30-31 (1950) *February* 16.

Excise taxes adopted during the war to discourage production and consumption of consumer goods in favor of increased production of war material must be repealed. These taxes depress employment in the fields they cover, dictate to the consumer how he shall spend his dollar, unfairly discriminate against certain industries in peacetime and increase prices to the consumer, having their greatest impact on the low-income group. Gas appliance manufacturers are among those adversely affected by these taxes. The committee formed to work for repeal has gas appliance representatives as vice-chairman and secretary.

J. C. Lane

East Ohio Case

PUBLIC UTILITIES REPORTS—FEDERAL POWER COMMISSION VS EAST OHIO GAS COMPANY ET AL. *Public Utilities Fortnightly* **45**, Report No. 1, 1-17, (1950) *March* 2.

The U.S. Supreme Court reversed the findings of a Federal Court in the FPC-East Ohio Gas Company case, ruling that East Ohio is a natural gas company within the meaning of the Natural Gas Act. The majority opinion was largely based upon the fact that East Ohio transports natural gas in high pressure lines from the state line to distribution centers, hence becoming a carrier of natural gas in interstate commerce. Justices Jackson and Frankfurter dissented on the basis that East Ohio is an all-Ohio company deriving income solely from distributing gas directly to Ohio consumers and selling no gas for resale. The dissenting justices pointed out that the majority decision set a precedent for FPC usurpation of regulatory powers previously exercised by state commissions.

J. C. Lane

House Heating

Harvey, L. C. GAS HOUSE HEATING LOAD— INSURANCE FOR MODERN ALL-GAS HOMES. *Am. Gas Assoc. Monthly* **32**, 38-40, 64 (1950) *February*.

Placing gas heating in the home is the best insurance for making that home an all-gas home. National sales of gas central heating equipment exceeded sales of comparable oil-burning equipment in 1946 and 1949, years when few restrictions on gas use were in effect, and lagged far behind in 1947 and 1948 when insufficient gas supplies forced curtailment of new heating installations. In 1949, gas heated 17.5% of the nation's homes as contrasted with 11% in 1940. The proportion of centrally heated gas homes, a gauge of the Northern market, increased from 8% in 1940 to 13% in 1949. While these increases are encouraging, they by no means approach the saturation possible and desirable to insure holding and increasing the place of gas in the home. For example, the saturation of gas-heated homes in Cleveland, Ohio, increased from 10% in 1940 to about 50% in 1950 and is expected to grow to 70-80% in a very few years. The availability of natural gas, with its unquestioned convenience and economy is responsible for the showing in Cleveland. National figures are expected to reflect the increased availability of natural gas as building or projected pipe lines are completed.

J. C. Lane

Natural Gas Act

Behling, B. N. SHIFTING FPC VIEWPOINT OBSCURES INTENT OF NATURAL GAS ACT. *Am. Gas J.* **172**, 13-15, 45 (1950) *February*.

The gradual changes in interpretation of the Natural Gas Act as it affects or does not affect producers and gatherers are traced in detail. It appears that the Federal Power Commission recognized the exempt status of independent producers and gatherers during the early years of the Act. As time passed, the FPC sought to extend its control over the price of all gas destined for interstate commerce from well-head to consumer. Strengthened in its

position by some court rulings, the Commission now seeks to regulate the operation of independent producers and gatherers and will continue its search for ever greater regulatory powers until Congress amends the law to define its coverage without any possibility of misinterpretation.

J. C. Lane

New York Area Plans

Callahan, J. P. NATURAL GAS—EVERYBODY'S DARLING. *Public Utilities Fortnightly* 45, 275-278 (1950) *March* 2.

The advent of natural gas to the New York City area is examined as to its potential effects on operations and rates. The quantities available to the various utilities and their anticipated use of this natural gas are discussed.

J. C. Lane

Oil Industry

OUR MAJOR PROBLEMS AS VIEWED BY OIL INDUSTRY LEADERS. *Independent Petroleum Assoc. of America Monthly* 20, 22-25, 49 (1950) *February.*

The major problems of the oil industry seem primarily to evolve from government action or potential action. Reduction or elimination of the 27.5% depletion allowance in computing income tax would adversely affect production. Taxation is a chronic burden. Importation of foreign oil and the tidelands controversy are other problems cited.

J. C. Lane

Promotion

1950 PLANS OFF TO FLYING START. *Am. Gas Assoc. Monthly* 32, 41 (1950) *February.*

The American Gas Association's 1950 promotional campaign on domestic gas appliances will include a dynamic series of regional sales meetings in Boston, St. Louis, Pittsburgh, Houston, Milwaukee, New York and Birmingham, Ala. A complete presentation of the 1950 promotional plans with publication dates of the national advertising campaign will be made at the meetings so dealers and utilities may coordinate their efforts with the national campaign. Promotion of automatic gas clothes dryers and water heaters is the first 1950 national advertising effort, closely followed by a Spring Style Show of automatic gas ranges.

J. C. Lane

The following articles, which have not been abstracted, are also called to your attention:

Martin, E. R. HOW APPLIANCES WILL SELL IN 1950. *LP-Gas* 10, 112-113, 158, 160, 162 (1950) *February.*

NATURAL GASOLINE OUTPUT RISES 50 PER CENT IN FIVE YEARS. *World Oil* 130, 132-133 (1950) *February* 15.

PIPE LINE ACTIVITY IN 1949. *World Oil* 130, 172, 174, 176, 178, 181 (1950) *February* 15.

2. APPLIANCES

Refrigeration

Berestneff, A. A. ABSORPTION REFRIGERATION. *Mech. Eng.* 72, 216-220 (1950) *March.*

A description is given of a large capacity (200 to 350 tons) absorption refrigerating unit utilizing lithium bromide and water. This machine functions in a manner similar to that of the conventional 3 to 5 ton air conditioner. The major difference is that the large capacity unit is operated under a vacuum and a purging system is added to remove noncondensables which leak into the machine. Cooling towers cannot be utilized directly because of the inclusion of noncondensables, thus a water to water heat exchanger must be provided.

E. F. Davis

The following article, the abstract for which appears on the page indicated, is also called to your attention:

Clifford, E. A. A PRACTICAL GUIDE TO LP-GAS UTILIZATION. CHAPTER 12. GAS BURNERS. p. 64

3. COMBUSTION AND INDUSTRIAL FURNACES

Combustion Mechanism

Bangham, D. H. and Crone, H. G. INTERNATIONAL CONFERENCE ON THE MECHANISM OF THE COMBUSTION OF CARBON. *Bull. Brit. Coal Utilization Research Assoc.* 13, 413-419 (1949) *December.*

The 22 papers presented during this conference at the University of Nancy, September 27-30, 1949 are discussed under five headings: (1) the structure of carbon; (2) carbon filament experiments; (3) topochemical effects and reactivity; (4) the carbon-oxygen surface complex; and (5) effects of inhibitors and catalysts. The authors and titles of the papers are listed in an appendix.

A. J. Rudnitzki

Spalding, D. B. COMBUSTION OF LIQUID FUEL IN A GAS STREAM—II. *Fuel* (British) 29, 25-32 (1950) *February.*

Experiments are described in which kerosene is burned by natural convection from the surface of a vertical plate and a sphere in air of various oxygen contents. The combustion rates are found to accord broadly with those predicted theoretically and some light is thrown on the combustion mechanism and the causes of smoke formation. The implications of the theory and experiments for the combustion of fuel sprays are discussed, with particular reference to gas turbines.

Author's abstract

Glass Manufacture

GAS MAKES GLASS FOR OWENS—CORNING. *Gas* 26, 30-31 (1950) *March.*

Molten glass from a gas-fired regenerative furnace is allowed to flow out through very small metal orifices thereby forming fine glass fibers. By use of a number of orifices closely spaced and by collecting the fibers on a conveyor belt, a fiber glass blanket is formed. The fibers are then sprayed with a binder which is cured before the blankets are removed from a conveyor.

E. F. Davis

Knock-Free Engine

Weber, G. REVOLUTIONARY ENGINE. *Oil Gas J.* 48, 21-22 (1950) *March* 2.

Internal combustion engines capable of knock-free performance on a wide range of fuels have been developed by the Texas Company. Fuel, injected as in the Diesel cycle, is fed into a swirling stream of air to form a combustible mixture which is ignited by a spark plug and burned just downstream of the injection point. The swirling action reportedly prevents the auto-ignition responsible for knock in gasoline engines and the delayed ignition responsible for knock in Diesel engines. Laboratory tests indicate the new engines may be able to utilize as much as 71% of the normal refinery production from a barrel of crude as contrasted with the present ignition and Diesel engine use of 54%. If the new-type engine proves a commercial success, its effect on the petroleum industry will be revolutionary.

J. C. Lane

The following article, the abstract for which appears on the page indicated, is also called to your attention:

Wheatley, P. J. and Linnett, J. W. THE EFFECT OF PRESSURE ON THE BURNING VELOCITY OF ETHYLENE-AIR MIXTURES. p. 71

4. CARBONIZATION AND GASIFICATION

Carbonization

Kipling, J. J. CARBONIZATION OF COAL IN RELATION TO THE PRODUCTION OF ACTIVE CHARCOALS. *Fuel* (British) **29**, 42-47 (1950) *February*.

Variation in the conditions of carbonization has considerable effect upon the properties of the ultimate absorptive charcoals prepared from coals. A single blend of two coals was finely ground, briquetted, and carbonized at two rates; 35 minutes to 350 minutes, to heat from room temperature to 600° C with or without steam-sweeping. The cokes thus prepared were activated in steam at 890° C. The cokes prepared at slower rates of heating *without steaming* had higher yield, lower mechanical strength and lower apparent density. These cokes gave charcoals of higher absorptive volume-activity and weight-activity, lower mechanical strength and lower apparent density. When *steaming during the carbonization* there is a decrease in the yield of cokes and a slight increase in the absorptive activities of charcoals. With steaming, the cokes from fast carbonization show greater development of small pores, and no effect upon large pores. Preliminary experiments with other coal blends show that the behavior of different coals may vary considerably in sensitivity to rate of carbonization up to 600° C. Reheating of cokes made at 600° C to a temperature of 890° C for 30 minutes gave considerable changes in coke properties similar to those occurring during activation.

O. P. Brysch

Coke Oven

Bagley, D. BRITISH USE HIGH WALL COKE OVENS. *Iron Age* **165**, 95-96 (1950) *March* 2.

American carbonizing practice achieves 20 to 24 tons coal per oven per day in oven chambers 13 ft high at 16 hours coking time; British practice in Still coke ovens carbonizes 37 tons in chambers 19 ft 8 in. high at 20 hours coking time. Still ovens in Britain have annual coal carbonizing capacity of 2,204,000 tons. Uniformity of wall temperatures (± 30°C) in the Still ovens is attained by multi-stage combustion, using either the side jet (six vertically superimposed gas nozzles firing into the flue) or the underjet (one gas jet at base of flue.) The side jet is used with blast furnace gas (with *air and gas* entering in *alternate* side-jet ducts) while the underjet is used most effectively with coke oven gas (with *air only* entering in *all* side-jet ducts.) The former achieves complete combustion at each of six vertical levels, while the latter obtains graduated combustion by adjusted air doses at the six levels. Both systems of firing can operate simultaneously on adjacent ovens, and changeovers from one system to the other or one gas to the other take but a few minutes.

O. P. Brysch

Abstractor's Note: The survey of trends in the coking industry (Hicks and Lee, United Nations Sci. Conf., Lake Success) estimate coal carbonized in 1948 in Great Britain coke ovens to be 22,300,000 tons.

Coke Screening

Hancock, R. T. SIZE DISTRIBUTION IN RETORT COKE. *Coke & Gas* (British) **12**, 60-61 (1950) *February*.

The advantages of the arithmetic probability scale for plotting cumulative screen test data are discussed. The importance of the mean size and the standard deviation is illustrated by published examples of coke from ovens and retorts.

O. P. Brysch

High-Ash Coal

Gumz, W. A SUGGESTED SOLUTION TO BURNING HIGH-ASH COAL. *Combustion* **21**, 57-59 (1950) *February*.

A two-stage process comprising gasification of the coal in a special producer and combustion of the gas in a gas-furnace, is proposed for the utilization of high-ash coals. The gas producer chosen for this operation is the recently developed Flesch-Winkler producer,

which is characterized by down-draft gasification in a fixed bed. The bed is fluidized at intervals, in order to separate the lump slag from the fine char. Fresh fuel is added during the fluidizing period, insuring intimate mixing with the devolatilized non-coking char. Elimination of ash from the furnace increases the rate of heat release and permits pressure combustion.

W. E. Ball

Humic Acids

Ahmed, M. D. and Kinney, C. R. PYROLYSIS OF HUMIC ACIDS PREPARED FROM OXIDIZED BITUMINOUS COAL. *J. Am. Chem. Soc.* 72, 556-559 (1950) *January.*

The investigation of humic acids prepared from bituminous coal has been continued with a series of pyrolysis tests. Only 13% of the carbon was evolved as volatile substances, the 950°C residue containing 90% carbon. From the amount of carbon dioxide evolved, the equivalent weight of the humic acids was calculated to be 242, a value which corresponds closely with that found by other investigators. No volatile aromatic fragments were observed. The authors conclude that the humic acids contain amorphous carbon in the nuclei of their molecules.

W. E. Ball

Ahmed, M. D. and Kinney, C. R. OZONIZATION OF HUMIC ACIDS PREPARED FROM OXIDIZED BITUMINOUS COAL. *J. Am. Chem. Soc.* 72, 559-561 (1950) *January.*

Humic acids, carbon black, graphite oxide, and acids from carbon black were ozonized. Humic acids formed carbonic and oxalic acids, accounting for 65% of the carbon. Practically all the remaining carbon was converted to almost colorless, water-soluble acids. Comparison of the humic acid results with those obtained from the other substances did not definitely establish whether the humic acids are of basically aromatic or amorphous carbon structure.

W. E. Ball

Methane Synthesis

Dent, F. J. and Hebden, D. THE CATALYTIC SYNTHESIS OF METHANE AS A METHOD OF ENRICHMENT IN TOWN GAS MANUFACTURE. Gas Research Board Communication GRB 51 41 p. (1949) *November.*

The catalytic synthesis of methane has been investigated intermittently since 1938 by the Gas Research Board (Great Britain). Pilot scale tests which ran continuously for four months demonstrated that gas recirculation was suitable for controlling catalyst temperature at high gas conversion rates (space velocity of 2000 volumes of inlet gas per volume of catalyst-hr). At atmospheric pressure, it was indicated that 500 Btu/cu ft gas could be made, while at 20 atmospheres pressure, gases of more than 700 Btu/cu ft heating value could be produced. The catalyst, nickel-alumina on china clay, was sensitive to sulfur poisoning. Means were provided for reducing the total sulfur content of the inlet synthesis gas to 0.002 grains per 100 cu ft in order to prevent deactivation of the catalyst. Two applications of catalytic methanation are suggested. First, synthesis is proposed for enrichment of blue water gas during off-peak production as a means of reducing oil consumption. Second, pressure gasification of coke breeze with oxygen is suggested for the production of synthesis gas followed by enrichment through use of the catalytic methanation process. Costs are estimated for English conditions.

C. H. Riesz

Producer Gas

Gollmer, W. THE GASIFICATION OF LOW-GRADE FUELS. *Coke & Gas* (British) 12, 64-69 (1950) *February.*

The gasification of colliery wastes high in mineral matter content is considered as a source for low cost producer gas for by-product coke oven firing. Among the processes showing promise for the conversion of these wastes to gas are the modified "Schweitzer" retort and the Rombach producer. The Schweitzer process, consisting simply of an open vertical cylinder filled with the material to be gasified, was originally used in the gasification of walnut size

shale, but has since been modified by using cooling inserts (to prevent ash fusion) in the conversion of 70-80% ash colliery waste to a 90-100 Btu producer gas. The Rombach producer consists of an entirely refractory brick structure in which high ash content material is handled by up-blasting with steam-air mixtures, at usually ash slagging conditions. Operating data and a typical industrial scale layout for the Schweitzer process are given.

C. von Fredersdorff

Purification

Madson, J. A. THE PURIFICATION OF TOWN'S GAS. *Gas Times* (British) 62, 251-252 (1950) *February* 24.

The dry oxide process continues to be the most widely-used method for hydrogen sulfide removal. Attention is called to recent British research directed at minimizing hardening and back pressure. There are now several semi-mechanical modifications of the original oxide-box process. Experimental work with the fluidized bed technique appears encouraging, and the same may be said for extraction of sulfur from spent oxide. In regard to liquid purification processes, one plant has had two years experience with the Manchester (ammonium carbonate) process. The favorable results obtained by this plant have led to the construction of two larger plants.

W. E. Ball

Water Gas Sets

Strader, R. H. CON-EDISON INCREASES WATER GAS CAPACITY AT ITS ASTORIA MANUFACTURING PLANT. *Am. Gas J.* 172, 10-12 (1950) *February.*

Four new, automatic UGI carbureted water gas sets were put in service by the Consolidated Edison Co. of New York in their Astoria plant. This addition, which is expected to increase the 537 Btu gas capacity by 44,000 Mcf per day, was required in spite of anticipated natural gas receipts equivalent to 55,000 Mcf per day late in the fall of 1950. The set dimensions are: mechanical generators—10 ft. inside diameter, 22 ft- 9 in. height; carburetors—13 ft. diameter, 26 ft. height; superheaters—13 ft. diameter, 46 ft. height. The units are fitted with back-run equipment and designed for heavy oil. Extremely high blower capacity (rated at 45,000 cfm at 77 inches of water) is provided to permit high blast operation. Many other interesting details of this installation are given in the article.

H. R. Linden

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Garrett, W. R. ELECTRICAL ANTI-FREEZING FOR GASHOLDER CUPS. p. 64

Hulswit, C. L. 15 YEARS OF NATURAL GAS 30 MILES FROM 42nd STREET. p. 62

MEETING PEAK DEMANDS WITH BUTANE GAS. p. 64

METER-CLEANING MADE EASY WITH AUTOMATIC METHODS. p. 64

5. NATURAL GAS AND NATURAL GAS CONDENSATES

Bureau of Mines Research

Cattell, R. A. and others. REPORT OF PETROLEUM AND NATURAL-GAS BRANCH FISCAL YEAR 1949. U.S. Bureau of Mines Information Circular 7551 (1950) February.

Progress of the Bureau of Mines research during 1949 relevant to gas and oil production, properties, transmission and utilization is summarized. Of particular interest to the natural gas industry are studies of subsurface pressure instruments, core properties, pipe line flow, denitrogenizing of natural gas and new uses of helium. Much of the material is repetitive of that reported for 1948 since many of the projects are continued from year to year.

J. D. Parent

Changeover

Hulswit, C. L. 15 YEARS OF NATURAL GAS 30 MILES FROM 42nd STREET. *Gas* 26, 27-29 (1950) *March.*

The experience of Rockland Gas Company, located near New York City, in converting

to natural gas 15 years ago may prove interesting to companies in the area which are now contemplating change-over. Prior to the war, while natural gas was still somewhat more expensive than coal and oil, the load increased by 6.9 times during eight years of natural gas distribution, the maximum daily load increased to 16 times that in the last year of manufactured gas sendout, the annual load factor dropped from 88 per cent to 37 per cent and the space heating saturation rose from zero to 16 per cent. With gas the most economical as well as most convenient fuel, the load in 1949 was twice that in 1942. To prevent drying out of the jute-wrapped joints in its distribution system, the company humidified its natural gas. However, this was found ineffective in distant points of its low-pressure system, so the joints were allowed to dry completely and a jute-swelling liquid was pumped into the mains. After seven years the joints are still gas-tight. The most serious trouble encountered in the change-over was pilot outages caused by dust. Dust filters were installed on all pilots giving evidence of dust trouble. The company blew as much dust as possible out of the high-pressure systems at points located in safe places.

J. C. Lane

Compressor Lubrication

McNall, F. M. and Flaherty, E. H. GAS COMPRESSOR LUBRICATION. *Oil Gas J.* **48**, 63-64, 69 (1950) *February* 2.

Operating conditions and type of gas the compressor operates on are determining factors in lubrication. The use of low flash point oils is becoming more general since they do not tend to form hard carbon deposits on cylinder walls.

W. G. Bair

Compressor Stations

Fowler, N. V., Jr. REMOTE CONTROLS INSURE SAFETY IN BIG INCH STATIONS. *Gas* **26**, 75-76 (1950) *February*.

Texas Eastern Transmission Corporation has recently completed the installation of remote controlled automatic station suction, discharge and bypass valves in each of its compressor stations. The method of operating the valves is described in detail.

O. T. Bloomer

Grant, W. C. TENNESSEE GAS TRANSMISSION OPERATES NEW COMPRESSOR. *Gas Age* **105**, 22-23 (1950) *March* 2.

A new 1600 hp Worthington angle compressor, called Uniflo Type UTC16 has been in use since February at TGT compressor station No. 6. It features more efficient scavenging due to increased port area. Other features include a removable cylinder liner.

J. D. Parent

Hicks, T. G. PLANNING MODERN GAS-COMPRESSOR STATIONS—III. COMPRESSOR COOLING. *Oil Gas J.* **48**, 73-74, 76-77 (1950) *March* 2.

This installment is concerned primarily with cooling water and contains many valuable hints.

J. D. Parent

Hicks, T. G. PLANNING MODERN GAS-COMPRESSOR STATIONS. IV. COOLING EQUIPMENT, AIR FILTERS, EXHAUST SYSTEMS. *Oil Gas J.* **48**, 86, 88, 90, 92 (1950) *March* 9.

This fourth installment of a series includes a discussion of cooling water and engine exhaust systems.

J. D. Parent

Hicks, T. G. PLANNING MODERN GAS-COMPRESSOR STATIONS. PART V. SAFETY DEVICES AND STATION HEATING. *Oil Gas J.* **48**, 95-97 (1950) *March* 16.

The importance of automatic controls and safety devices for compressors is stressed. A table of safety devices is given. Also discussed in general terms are station heating, recovery of heat from exhaust gases, starting-air compressors and miscellaneous equipment.

J. D. Parent

AUTOMATIC COMPRESSOR STATION BOOSTS GAS-LINE PRESSURE. *Gas Age* **105**, 24-26, 52-54, 56, 58 (1950) *March* 2.

An automatically controlled compressor sta-

tion used intermittently when required by peak loads is described. Safety features are discussed.

J. D. Parent

Distribution

Garrett, W. R. ELECTRICAL ANTI-FREEZING FOR GAS HOLDER CUPS. *Gas* **26**, 33-34 (1950) *March*.

Lead sheathed electrical heating cable is strapped to the dip plates of a water sealed gas holder and used for heating the water to prevent freezing.

E. F. Davis

METER-CLEANING MADE EASY WITH AUTOMATIC METHODS. *Gas* **26**, 37 (1950) *March*.

A description is given of a gas meter washing machine utilizing trichloroethylene as a solvent. The machine will handle 80 meters per hour and thus far has resulted in a savings of 10¢/meter repair.

E. F. Davis

LP-Gas

Clifford, E. A. A PRACTICAL GUIDE TO LP-GAS UTILIZATION. CHAPTER 12: GAS BURNERS. *LP-Gas* **10**, 35, 38-44, 46, 48, 50 (1950) *March*.

An excellent elementary discussion of combustion principles, gas burners and methods for adjusting burners is presented.

E. F. Davis

Pipe Lines

Harwick, R. SUPER-INCH NORTHERN LEG OF P. G. & E. 34-INCH LINE NEARLY COMPLETED. *Oil Gas J.* **48**, 50-52 (1950) *February* 2.

Eighty miles of this 34 in. line are now nearly completed and eventually will deliver 400 million cu ft per day at 800 psi to the San Francisco area. Heavy construction problems involved remodeling the standard side boom tractors to handle the heavier pipe. The world's largest ditching machine is also in use on this job. A 30 in. line was originally planned but calculations showed that the use of the 34 in. line would eliminate one compressor station and reduce total compressor horsepower requirements by 20%.

W. G. Bair

MEETING PEAK DEMANDS WITH BUTANE GAS. *Gas Age* **105**, 34, 58, 60 (1950) *March* 2.

Three Pennsylvania gas companies have installed catalytic cracking plants to make peak load gas from butane. A 42-foot diameter Hortonsphere is used at each plant to store its principal supply of butane (6800 barrels). Some other details are also presented.

C. H. Riesz

Robinson, E. T. BIG INCH MAJOR CONSTRUCTION JOB TO BOOST SYSTEM CAPACITY TO 740 MMcf NEARS COMPLETION. *Gas* **26**, 77, 80 (1950) *February*.

The construction program of Texas Eastern Gas Transmission Corporation to increase the capacity of its system to 740 MMcf is reviewed.

O. T. Bloomer

Production

Allen, F. H. and Roe, R. P. PERFORMANCE CHARACTERISTICS OF A VOLUMETRIC CONDENSATE RESERVOIR. T.P. 2708. Trans. AIME **189**, 83-90; *J. Petroleum Technol.* 2, (1950) *March*.

The performance history of a volumetric gas condensate reservoir is presented. Curves depict the pressure-production relation and illustrate the phase hebavior of the reservoir fluid. This performance is compared to calculated performance. This Bacon Lime Reservoir was discovered in 1941 and has been produced to field separators and gas sales. Reservoir performance has been observed by periodic bottom hole pressure surveys and companion sample analysis of well effluents, in addition to gas and condensate production data. The pressure-production history demonstrates that the reservoir has produced under volumetric control. The "retrograde" behavior of the reservoir fluid is illustrated by decreasing butanes-plus content of the well effluent, followed by revaporization as the reservoir pressure ap-

proaches abandonment. Calculated performance predictions are compared to actual performance and some discussion offered on apparent discrepancies.

Authors' abstract

Battle, J. L. and Cheney, P. E. LIME-BASE MUDS. . . . A PROGRESS REPORT. *Oil Gas J.* 48, 81-83 (1950) *March* 16.

This is a progress report of an API committee which has been studying the use of lime base muds. Some elementary theoretical considerations of the chemical behavior of the system are presented.

J. D. Parent

Deegan, C. J. NEW LOGGING METHOD. *Oil Gas J.* 48, 23 (1950) *March* 2.

Announcement is made of a new logging instrument which gives both a gamma ray and a neutron log in a simple run in the hole. The neutron log measures slow neutrons only. A sample log is included.

J. D. Parent

Doll, H. G. THE MICROLOG. *Oil Gas J.* 48, 62, 64, 69 (1950) *March* 2.

A "Microlog" is a resistivity log obtained when using electrodes spaced much more closely than for conventional logging, say one to two inches. Sharper differentiation is possible. A diagram and explanation of the characteristics of the new device are presented. A bibliography of six articles on logging is included.

J. D. Parent

Gilchrist, L., Rostoker, N. and Bernholtz, B. DISTRIBUTION OF POTENTIAL IN A TWO-LAYERED MEDIUM DUE TO AN INTERNAL SOURCE AND SINK AND THE DETERMINATION OF THE APPROXIMATE AVERAGE RESISTIVITY OF THE MEDIUM. *Can. J. Research* 28*A*, 1-28 (1950) *January.*

A brief review is presented of simple forms of electrical layout which are used in resistivity investigations on the upper surface of a two-layered medium of which the crust of the earth is assumed to be an example. The associative formulas for resistivity are given. The necessity for equalization in magnitudes of the source and the sink in all experimental methods of resistivity investigation is emphasized in order to be in accord with the basis of development of the formula, and in order to eliminate experimentally pseudo anomalies which may appear in homogeneous media. Formulas are developed for use in conjunction with experimental results obtained by use of drill holes whereby the source and sink are embedded in a two-layered medium. Distinction is made in the cases where the source and sink are remote from, or are in the neighberhood of, the plane of separation of the layers. Some experimental results on the values of the interbowl resistance, R, are presented in comparison with the values of R that would be obtained from a medium of two homogeneous layers of a suitably chosen resistivity p. The local anomalies in these layers appear clearly.

Authors' abstract

Hines, L. E. THE CRANFIELD CYCLING-PRESSURE MAINTENANCE UNIT. PART II. GENERAL OPERATIONAL PLAN. *World Oil* 130, 139-144 (1950) *March.*

The overall operational plan of production and phases of the reservoir and production engineering associated with properly depleting the indicated reserves of the Cranfield field, are discussed in this article. The first part of the series treated of the basis of the Cycling-Pressure Maintenance Unitization Agreement.

Author's abstract

Leas, W. J., Jenks, L. H., and Russell, C. D. RELATIVE PERMEABILITY TO GAS. T.P. 2810. *Trans. AIME* 189, 65-72; *J. Petroleum Technol.* 2 (1950) *March.*

A detailed description is given of an experimental method for determining relative permeability of porous media to gas. Results are presented for natural and synthetic cores. The experimental data for two and three phase systems are compared. The reproducibility of the equilibrium gas saturation is demonstrated and the effects due to a variation in rate of gas flow are discussed. An attempt is made to correlate total permeability and rock textural factors with relative permeability to gas. Capillary

pressure curves obtained simultaneously with the relative permeability curves are shown to be equivalent to those obtained in conventional displacement cells.

Authors' abstract

McDonald, J. F. PLASTICS IN GAS, WATER SHUTOFFS. *World Oil* **130**, 108-110 (1950) *March*.

Plastics such as the phenol formaldehyde type have been used by the oil industry since 1940 for controlling production by shutting off water or cap gas. A general discussion of the application of the technique and the care required is presented. Cleanliness of the formation, location of the fluid contact, bottom hole temperature and formation characteristics are all important.

J. D. Parent

Sloan, J. P. PHASE BEHAVIOR OF NATURAL GAS AND CONDENSATE SYSTEMS. *Petroleum Engr.* **22B**, 54, 56, 58, 60-64 (1950) *February*.

The occurrence and general properties of the various types of hydrocarbon reservoirs are reviewed. Methods and precautions in sampling condensate reservoirs are discussed. A stirred equilibrium cell used for laboratory study of the phase behavior and pressure volume relationship of reservoir fluids is described. Sources of error in the determination of the volume of liquid in the equilibrium cell are discussed. Typical data obtained on a condensate reservoir are presented.

O. T. Bloomer

Smith, R. V. DETERMINING FRICTION FACTORS FOR MEASURING PRODUCTIVITY OF GAS WELLS. T.P. 2777. *Trans. AIME* **189**, 73-82; *J. Petroleum Technol.* 2 (1950) *March*.

The theoretical background for calculating friction factors for flow in gas wells by two methods is presented. The first method, requiring pressures, temperatures and specific volumes of the flowing fluids at various depths in the well bore, shows how the mechanical-energy-balance equation for vertical flow may be graphically integrated over the actual path of the expansion of the fluid in the well. Thus, assumptions regarding the effective temperature and effective compressibility of the fluid in the well are avoided. The second method presents an equation derived on a basis of the assumptions that both the temperature and the compressibility are fixed at constant effective values throughout the flowing column of gas. The second method provides a convenient and practical means of calculating friction factors for gas wells and lends itself readily to the problem of calculating subsurface pressures in a flowing gas well. The application of both methods to actual test data taken on a flowing gas well is illustrated in the paper.

Author's abstract

Weaver, B. R. ACIDIZATION IN THE PERMIAN BASIN. *Oil Gas J.* **48**, 73-74, 76, 79, 95 (1950) *March* 9.

This article is a complete resumé of the author's experience in the acidization of wells. Results obtained with acidization in the Permian basin are presented.

O. T. Bloomer

Young, F. S. ASPECTS OF GAS HEAT EXCHANGERS AS APPLIED TO TRANSMISSION SYSTEM PROBLEMS. *Gas Age* **105**, 40-44, 80, 82, 84 (1950) *February* 16.

The use of gas as a cooling medium in transmission systems is discussed. Particular emphasis is placed on the use of cool compressor suction gas to transfer heat loads to the compressor aftercooler, thus simplifying piping layouts and equipment requirements. This has been used to advantage in the case of a glycol dehydration plant located on the discharge side of a compressor. The effective contact temperature was lowered to a value below that obtained in a cooling tower. Suction gas can also be used as a coolant for the compressor lubricating oil stream. Economic aspects of both of these applications are discussed.

O. T. Bloomer

Purification

Connors, J. S. and Miller, A. J. OPERATING PROBLEMS RELATED TO GAS TREATING. *Oil Gas J.* 48, 57-60 (1950) *February* 2.

The authors discuss H_2S removal by the iron oxide and amine type processes. Operating characteristics of various plants are given. Corrosion problems are prevalent when the amine type units are operated at excessive temperatures. Foaming is also a problem. Reduction of operating temperatures and use of anti-foaming agents corrected these difficulties.

W. G. Bair

Transmission

Owen, H. C., Jr. FLOW OF GAS IN PIPE LINES CONSIDERING DEVIATION FROM IDEAL GAS LAWS. *Oil Gas J.* 48, 71-72, 101 (1950) *March* 9.

The general flow equation is solved analytically for a non-ideal gas by assuming a linear relation between superexpansibility and pressure. This eliminates tedious plotting where the assumption is valid.

J. D. Parent

Wright, J. C. NEW DISPLACEMENT METHOD OF MEASURING GAS FLOW THROUGH PIPE LINES. *Oil Gas J.* 48, 99, 101, 102-103 (1950) *March* 16.

A displacement method of measuring flow in pipe lines is described. Aqueous ammonia is injected into the line at one point and the time elapsed before the ammonia arrives at a second point is measured. The ammonia is detected by bleeding the gas through a filter paper saturated with an indicator.

O. T. Bloomer

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

Bureau of Mines Annual Report

SYNTHETIC LIQUID FUELS. ANNUAL REPORT OF THE SECRETARY OF THE INTERIOR FOR 1949. PART I. OIL FROM COAL. *U. S. Bureau of Mines Report of Investigations* 4651 (1950) *February.*

The Bureau of Mines conducted research on oil-from-coal processes at various stations during 1949. At Louisiana, Mo., large-scale tests are under way. Initial operations were begun in the 200-300 bbl per day coal hydrogenation plant including one 7-week test run on coal. An 80 to 100 bbl per day gas synthesis plant was about 70% completed. A Koppers-type powdered coal gasifier has been operating since May. A cooperative agreement has been concluded with the A.G.A. concerning the operation of a Kerpely gas producer on pure oxygen. At Bruceton, Pa., laboratory studies were conducted. Synthesis through use of a "moving-catalyst-bed" involved catalyst suspended in a stream of liquid and gas. A "homologation" process which converts an alcohol into a higher, homologous alcohol has been disclosed. A vortex gasifier has been studied. At Morgantown, W. Va., pilot plant studies of coal gasification are under way. One unit provides steam superheated to as high as 3600° F, coal rates were as high as 490 pounds per hr. Another unit, of 25 to 50 pound capacity, gasified pulverized coal by combustion with oxygen. Tests on purifying and treating synthesis gas are in progress. At Gorgas, Ala., a second test on underground gasification of coal has been started. Approximately 3000 tons of coal has been burned and at times under proper conditions, the calorific value of the product gas has been high enough to make it combustible.

C. H. Riesz

SYNTHETIC LIQUID FUELS. ANNUAL REPORT OF THE SECRETARY OF THE INTERIOR FOR 1949. PART II. OIL FROM OIL SHALE. *U. S. Bureau of Mines Report of Investigations* 4652 (1950) *February.*

The mining of oil shale at Rifle, Colorado, has been improved in 1949 to achieve a production rate of 148 tons of shale per man-shift of under-

ground labor or 116 tons per man-shift of total labor in a 4-week demonstration test. Direct mining cost, excluding depreciation, office expenses and overhead, was 29 cents per ton of shale. The retorting of oil shale in N-T-U retorts is used to supply shale oil for the demonstration shale-oil refinery. This plant, over 200 bbl per day feed rate, was placed in operation in July, 1949. Pilot plant developments of gas-flow, oil-shale retorting processes are in progress. At Laramie, Wyo., the composition of oil shale and shale oil is being studied. Methods of processing these materials are being developed. Hydrogenation at low pressure (500 psig) reduced sulfur and nitrogen contents in the shale oil. Pyrrole has been isolated from shale oil and it is believed that compounds of this type cause color and gum formation in shale oil products. Estimates of shale-oil production costs indicate a cost at the combined mine-refinery of $3.07 per bbl with no return or $3.77 per bbl with 6% return after taxes. The oil costs are somewhat higher than current crude oil prices. Transportation of the shale oil to distant market centers and high capital investment, $41,381,000 for a 10,000 bbl per day shale-oil plant, are undesirable factors for commercial exploitation.

C. H. Riesz

SYNTHETIC LIQUID FUELS. ANNUAL REPORT OF THE SECRETARY OF THE INTERIOR FOR 1949. PART III. LIQUID FUELS FROM AGRICULTURAL RESIDUES. *U.S. Bureau of Mines Report of Investigations* 4653 (1950) *February.*

The Liquid Fuels Plant is located on the site of the Northern Regional Research Laboratory at Peoria, Illinois. The hydrolysis process under investigation consists in converting the pentosan fraction of agricultural residues to pentose sugars and subsequently converting the cellulose fraction to dextrose. Operation in 1949 showed 18% of the pentosans in air-dried corn cobs were not hydrolyzed. This high value was traced to a change in corn cob composition from unestablished causes. A pressure hydrolyzing procedure has been developed in the laboratory to reduce the unconverted amount to 7%. Fermentation of the pentosan hydrolyzates has been studied and it appeared advisable to supplement the media with cornmeal to improve yields of desired products, butanol, acetone and ethanol. The hydrolyzation of lignocellulose has been improved by uniform mixing of the solids with sulfuric acid.

C. H. Riesz

SYNTHETIC LIQUID FUELS. ANNUAL REPORT OF THE SECRETARY OF THE INTERIOR FOR 1949. PART IV. OIL FROM SECONDARY RECOVERY AND REFINING. *U.S. Bureau of Mines Report of Investigations* 4654 (1950) *February.*

The work during 1949 on secondary recovery is classified under four headings and is being carried out at five field offices and two suboffices. The work on refining has dealt with high-sulfur crudes and studies of pure sulfur compounds are being initiated.

C. H. Riesz

Ethylene Production

Buell, C. K. and Weber, L. J. ETHYLENE PRODUCTION BY CRACKING OF PROPANE-ETHANE MIXTURES. *Petroleum Processing* 5, 266-272 (1950) *March.*

Ethylene is produced by thermally cracking propane-ethane mixtures in a cracking furnace setting at temperatures of 1400-1500° F and at near atmospheric pressure and with reaction coil contact times under two seconds. The commercial cracking installation was designed for processing 8,143,000 cu.ft. day of feed. Three identical furnaces, each containing two complete sections, were built. It was found that the specific gravity of the cracked gases provided a reliable index of the degree of cracking. The usual value for operation was in the range of 0.80 to 0.85; at 0.725 specific gravity, the maximum yield of ethylene was found but at this deep cracking rate, tar and coke formation became excessive. Plant operating data are presented which show good agreement with pilot plant results. Factors involved in the design of the furnaces are discussed.

C. H. Riesz

NEW PROCESS . . . HIGHER YIELDS OF ETHYLENE FROM REFINERY GASES SEEN. *Oil Gas J.* 48, 25 (1950) *March* 2.

The conversion of ethane and/or propane to ethylene by "autothermic" cracking has been announced by two Universal Oil Products Company engineers. Refinery gases are subjected to partial combustion with air or oxygen to supply the heat required for the endothermic cracking reaction. The incoming gases and air or oxygen are raised to reaction temperature by indirect heat exchange with the product gases, no outside heat being required. Most ethylene is now produced from propane by tubular thermal cracking. The new process with ethane as feed is expected to produce ethylene in higher yields and at lower cost.

J. C. Lane

Fischer-Tropsch Synthesis

Eckstrom, H. C. and Adcock, W. A. A NEW IRON CARBIDE IN HYDROCARBON SYNTHESIS CATALYSTS. *J. Am. Chem. Soc.* 72, 1042-1043 (1950) *February.*

During the course of a fluidized synthesis test at 27 atmospheres pressure and 680°F, 90% of the iron catalyst (mill scale promoted by potassium carbonate) was converted into a new iron carbide. X-ray diffraction patterns indicate the new phase to be different from the Hägg carbide (FE_2C) although the new carbide is ferromagnetic and has the same Curie point (482°F ± 5.4°F) as the Hägg carbide. The iron-to-carbon atomic ratio is 0.96 indicating a phase equivalent to FeC. Heating at 1112°F converted the new carbide into cementite, Fe_3C.

C. H. Riesz

Friedel, R. A. and Anderson, R. B. COMPOSITION OF SYNTHETIC LIQUID FUELS. I. PRODUCT DISTRIBUTION AND ANALYSIS OF C_3-C_8 PARAFFIN ISOMERS FROM COBALT CATALYST. *J. Am. Chem. Soc.* 72, 1212-1215 (1950) *March.*

The distribution of Fischer-Tropsch synthesis products has been determined in the range, C_1 to C_{20}. The products were formed over cobalt catalyst at atmospheric pressure and at about 375° F temperature from synthesis gas containing 2 volumes of hydrogen for each volume of carbon monoxide. Analysis, by mass spectrometer, of the paraffin hydrocarbon fraction (71.7% of the C_3-C_9 cut) showed only monomethyl isomers present; the proportion of the predominant components, straight-chain isomers, decreased with increasing molecular weight. Approximate analysis by infra-red spectrometer of the olefin fraction (19.2% of the C_3-C_9 cut) showed that internal double-bond olefins were the major constituent. Preliminary results on iron-catalyst product are also reported.

C. H. Riesz

Hydrogenation

Grass, R. C. and Storch, H. H. COAL-TO-OIL RESEARCH AT BRUCETON, PA. *Chem. Eng. News* 28, 646-648 (1950) *February* 27.

The role of the Bureau of Mines synthetic fuel laboratories at Bruceton, Pa., is projected to render service in this field similar to that rendered by the Fixed Nitrogen Research Laboratory in the physics, chemistry and basic engineering involved in the synthesis of ammonia from its elements. The work currently under way is classified broadly either as direct or indirect hydrogenation of coal. The progress of this work is reviewed briefly. A comprehensive bibliography of the field of synthetic liquid fuels is being compiled.

C. H. Riesz

Sherwood, P. W. HIGH-PRESSURE HYDROGENATION OF CARBONACEOUS MATTER. PART III. PRIMARY HYDROGENATION IN THE LIQUID PHASE. *Petroleum Refiner* 29, 106-110 (1950) *February.*

The effect of operating variables on the high pressure hydrogenation in the liquid phase is discussed. A vehicle aids in controlling the process properly; generally the heavy oil obtained from the process itself is used as the vehicle. Temperature is usually maintained in the region 860° to 920°F, lower temperatures provide unsatisfactory conversion while higher temperatures lead to coke and gas formation. High pressure is essential to provide hydrogen

in solution; 10,300 psi appears to be a practical compromise, limited by mechanical difficulties. Throughput has a direct bearing on the nature of the products; a typical industrial value for bituminous coal is 1.2 tons per hr per 100 cu ft of reactor volume (10,300 psi pressure). The product of high pressure hydrogenation is a complex mixture of hydrocarbons and tar acids and bases. A close relationship has been observed to exist between the nature of the raw material and that of the products of the liquid phase. Tar acid recovery schemes employed in hydrogenation plants are similar to those used for coal tar processing.

C. H. Riesz

Sludge Formation

Butlin, D. G. STABILITY OF FUEL OIL GAS OIL BLENDS. *J. Inst. Petroleum* (British) **36**, 43-56 (1950) *January*.

A method using two simple laboratory tests is proposed to predict the results of the more complicated Centrifuge Sludge Test on the sludge formation of fuel oil gas oil blends. These two tests are the Aniline Point of the gas oil, and the Xylene Equivalent (X.E.) of the fuel oil as adapted from the Oliensis spot test. The X.E. test diluent shows a positive spot test at 0.2% by weight sludge. A gas oil with the same aniline point as the X.E. test diluent shows approximate same sludge formation.

D. L. Nicol

The following article, the abstract for which appears on the page indicated, is also called to your attention:

Cattell, R. A. et al. REPORT OF PETROLEUM AND NATURAL-GAS BRANCH. FISCAL YEAR 1949. p. 62

7. ANALYTICAL METHODS AND TESTS

Calorimeter

Armstrong, L. D. HIGH TEMPERATURE CALORIMETRY I. A NEW ADIABATIC CALORIMETER. *Can. J. Research* **28A**, 44-50 (1950) *January*.

A new form of adiabatic calorimeter is described of especial value for the measurement of specific heats at high temperatures. Small temperature intervals may be measured and a precision of 1% or better is claimed for the 400-800° C interval.

S. Katz

8. GENERAL AND PHYSICAL CHEMISTRY

Carbon Black Surface

Schaeffer, W. D., Polley, M. H. and Smith, W. R. THE NATURE OF CARBON BLACK SURFACES AS REVEALED BY ADSORPTION STUDIES. *J. Phys. & Colloid Chem.* **54**, 227-239 (1950) *February*.

Investigations of the nature of carbon black surfaces especially in relation to rubber reinforcement have been carried out. The effective carbon surface area available for interaction with large molecules is not necessarily the same as that revealed by nitrogen adsorption (Brunauer-Emmett-Teller). Heats of adsorption of n-decane and dihydromyrcene show a high degree of dependence on the unsaturation of the adsorbate as well as the concentration or identity of the oxygen complexes at the carbon surface.

S. Katz

Catalyzed Reaction Mechanism

Yang, K. H. and Hougen, O. A. DETERMINATION OF MECHANISM OF CATALYZED GASEOUS REACTIONS. *Chem. Eng. Progress* **46**, 146-157 (1950) *March*.

A summary is given of the general procedures in planning and correlating experimental data

for reactions catalyzed by solids. Means for eliminating, minimizing or evaluating temperature and concentration gradients in gas films and in catalyst pellets are expressed. Procedures for postulating and selecting appropriate reaction mechanisms based on several reaction variables are described.

C. H. Riesz

Corrosion

Van Rysselberghe, P., McGee, J. M., Gropp, A. H., Williams, R. D., and Delahay, P. POLAROGRAPHIC STUDY OF CORROSION PHENOMENA. I. INTRODUCTION-EXPERIMENTAL TECHNIQUE—ANALYSIS AND INTERPRETATION OF POLAROGRAMS. *Corrosion* **6**, 105-113 (1950) *March*.

The fundamental idea, resulting in the use of a polarograph, is that the consumption of oxygen, carbon dioxide, hydrogen peroxide, hydrogen ion, etc., may be followed quite closely by the use of polarographic techniques. Experimental techniques and the analysis of resulting polarograms are discussed in some detail.

B. E. Hunt

Flame Studies

Gaydon, A. G. FLAME SPECTRA. *Nature* **165**, 170-173 (1950) *February* 4.

Various types and techniques used in the study of flames through these spectra are reviewed. These include the use of low pressure flames in emission studies and of flat diffusion flames for both absorption and emission work. Most of the existing spectroscopic studies of combustion mechanisms have been based on interpretations of band spectra. The significance of the continuous emission spectrum is also discussed briefly.

S. Katz

Wheatley, P. J. and Linnett, J. W. THE EFFECT OF PRESSURE ON THE BURNING VELOCITY OF ETHYLENE-AIR MIXTURES. *Trans. Faraday Soc.* **45**, 1152-1158 (1949) *December*.

The burning velocity of ethylene-air mixtures at atmospheric and reduced pressures varies inversely as the fourth root of the pressure, confirming the theory of Tanford and Pease. Furthermore, there are linear relationships between the burning velocity and the ratios p_H/P, p_O/P and p_{OH}/P where p_H, p_O and p_{OH} are the calculated equilibrium partial pressures of H and O atoms and OH radicals at the flame temperatures and P is the total pressure.

A. J. Rudnitzki

Surface Area of Carbon

Bartell, F. E. and Dodd, C. G. SURFACE AREAS OF CRYSTALLINE CARBON AND CARBON POWDERS AS MEASURED BY THE ADSORPTION OF NITROGEN. *J. Phys. & Colloid Chem.* **54**, 114-128 (1950) *January*.

A comparison of various methods of determining surface areas of powders is described. Several graphites were studied as well as furnace black, silicon carbide and diamond dust. The procedures used included the simple or "infinity" B.E.T. adsorption equation, the complete B.E.T. equation and the Harkins-Jura adsorption isotherm equation. It is concluded that the complete B.E.T. equation is the most generally applicable, and the ranges of effective use of the other two equations are indicated.

S. Katz

Thermal Diffusion of Oxygen

Whalley, E., Winter, E. R. S. and Briscoe, H. V. A. DIFFUSION PHENOMENA IN GASES. PART I. THE THERMAL DIFFUSION OF OXYGEN—EXPERIMENTAL. *Trans. Faraday Soc.* (British) **45**, 1085-1090 (1949) *December*.

The thermal diffusion factor for oxygen was measured for three sets of temperatures by measuring the degree of concentration of heavy isotopes in an O^{18} enriched oxygen. A detailed description is given of a concentric tube form of thermal diffusion column together with performance data when used to concentrate O^{18}.

S. Katz

Whalley, E. and Winter, E. R. S. PART II. THE THERMAL DIFFUSION OF OXYGEN —THEORETICAL. *Trans. Faraday Soc.* (British) **45**, 1091-1097 (1949) *December*.

Theories of thermal diffusion are discussed and are applied critically to the data described in

the previous abstract. The disturbing effect of turbulence in the operation of a thermal diffusion column is considered, and errors due to the use of inadequate molecular models are discussed.

S. Katz

Thermodynamics

Kobe, K. A. and Long, E. G. THERMOCHEMISTRY FOR THE PETROCHEMICAL INDUSTRY. PART IX. THE HALOGENS AND HALOGEN ACIDS. *Petroleum Refiner* **29**, 124-128 (1950) *February*.

This series pertains to thermal data on halogens and their acids. Tables include references to reliable sources of experimental data, heats and free energy of formation, heat capacities between 0° to 1700° C or its equivalent on four different temperature scales, their corresponding enthalpies and mean heat capacities between temperatures mentioned and constants for the empirical cubical equation on specific heat at constant pressure.

S. Mori

Kobe, K. A. and Long, E. G. THERMO-CHEMISTRY FOR THE PETROCHEMICAL INDUSTRY. PART X, THE CHLOROMETHANES. *Petroleum Refiner* **29**, 157-160 (1950) *March*.

The tenth in a series of articles concerning the thermal properties of different gaseous groups common in the petroleum industry revolves around the chloromethanes. As previously, tables on the most reliable reference sources of data, free energies and heats of formation, heat capacities and enthalpies on four different temperature scales between 0 and 1200°C or their equivalents, mean heat capacities, and the coefficients for the empirical heat capacity equations are presented.

S. Mori

Thomas, L. H. CORRELATION OF CRITICAL TEMPERATURE, BOILING POINT, AND CRITICAL PRESSURE. *J. Chem. Soc.* (British) **1949**, 3411-3415 (December)

The author shows that the critical pressures, critical temperatures and boiling points of a large group of organic compounds, including hydrocarbons, oxygenated compounds, silicon, sulfur, nitrogen and halogen derivatives, may be determined from additive properties assigned to the constituent atoms and their bonds.

S. Katz

Thomas, L. H. CORRELATION OF CRITICAL TEMPERATURE, VAPOR PRESSURE, AND LATENT HEAT OF VAPORIZATION. *J. Chem. Soc.* (British) **1949**, 3415-3419 (December)

The examination of experimental data leads to the observation that the ratio of latent heats for pairs of substances is constant at the same reduced temperatures. A precise vapor pressure-temperature equation has been derived from this relation, and methods of estimating latent heats over the entire range from limited vapor pressure data are proposed.

S. Katz

Weller, S., Denbigh, K. G. and Raumann, G. THERMO-OSMOSIS OF GASES THROUGH A MEMBRANE. *Nature* (British) **165**, 199-200 (1950) *February* 4.

A theoretical explanation of the thermo-osmosis of carbon dioxide and hydrogen through rubber diaphragms is advanced by Weller, leading to the equation

$$\log (k_1/k_2) = Q^*/R(1/T_1 - 1/T_2)$$

where k is the gas solubility constant and Q* is related to the heat of solution. This leads to the conclusion that gases with a negative solubility coefficient-temperature dependence will show a flow from cold to warm, and vice versa. This interpretation is criticized by Denbigh and Raumann, who regard Q* as the "heat of transport" across the membrane, rather than the heat of solution. Some limited experimental support of this argument is cited. Extensions to the cases of surface adsorption, catalysis, etc., are cited.

S. Katz

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Armstrong, L. D. HIGH TEMPERATURE CALORIMETRY. A NEW ADIABATIC CAL-

ORIMETER. p. 70

Spalding, D. B. COMBUSTION OF LIQUID FUEL IN A GAS STREAM. p. 59

10. CHEMICAL ENGINEERING

Equilibrium Calculations

Montross, C. F. FLASH EQUILIBRIUM CALCULATIONS: A MODIFIED RIGOROUS METHOD. *Chem. Eng. Progress* **46**, 105-108 (1950) *February.*

The author proposes a method of making flash equilibrium calculations which reduces the number of trials required and fixes the end point mathematically.

W. J. Merwin

Fluid Flow

Thompson, A. S. FLOW OF HEATED GASES. *J. Applied Mechanics* **17**, 91-98 (1950) *March.*

The author sets up the basic differential equations for heat flow from a hot surface to a flowing compressible fluid. This equation is then written in dimensionless form by using the Mach number and total temperature and pressure ratios. The expression is integrated for an isentropic process and again for a constant Mach number. These two processes are then combined to represent actual processes. In order to match the physical process, it is necessary to integrate over a series of small steps. Graphs are presented to facilitate this stepwise integration.

R. E. Peck

Heat Transfer

McAdams, W. HEAT TRANSFER. *Chem. Eng. Progress* **46**, 121-130 (1950) *March.*

The author gives a general survey of the current work in heat transfer by conduction and convection. Reference is made to some of the newer analogies between heat transfer and fluid flow, and mass and heat transfer. Several articles on boiling film coefficients are reviewed. Several fields, needing further research work, are mentioned.

R. E. Peck

Mass Transfer

Maisel, D. S. and Sherwood, T. K. EVAPORATION OF LIQUIDS INTO TURBULENT GAS STREAMS. *Chem. Eng. Progress* **46**, 131-138 (1950) *March.*

New data are presented on the evaporation of liquids from wetted plane surfaces, cylinders, spheres and discs. Water was evaporated into air from each of the shapes and into carbon dioxide and helium from cylinders; benzene and carbon tetrachloride were evaporated into air from cylinders; and benzene was evaporated into air from spheres. Correlation of data for cylinders by means of j factors was successful, data on mass transfer, heat transfer, and friction agreeing well in the Reynolds number range of 1,000 to 30,000. For spheres, different lines were obtained for heat transfer, benzene-air runs, water-air runs, and unpublished work on evaporation from small liquid droplets. Agreement for mass and heat transfer and friction data is good for flat surfaces involving no dry or unheated approach section near the leading edge. For flat surfaces with a dry or unheated leading edge, the ratio of leading edge to total length must be included in the correlation. The Reynolds number for the flat surfaces substitutes the length for the diameter term. For flat surfaces, cylinders, and spheres, the power on the Reynolds number term in the j factor equation was —0.2, —0.43 and —0.44 respectively.

C. L. Tsaros

Oxygen Manufacture

Bliss, H. OXYGEN-ENRICHED AIR. THERMODYNAMIC ANALYSES OF PROCESSES FOR ITS MANUFACTURE. *Chem. Eng. Progress* **46**, 67-73 (1950) *February.*

A thermodynamic analysis is given for the manufacture of enriched air of 30, 40 and 50% oxygen content when using (a) "cascade" refrigeration and (b) refrigeration by expansion engine. Calculations on the minimum theoretical energy required for the separation show that enriched air containing 50% oxygen requires at least 0.447 hp-hr/lb mole oxygen in the product. Due to heat leak and irreversibility of compression, expansion and heat

transfer, a practical analysis of a low pressure expander process using a double column with maximum extra air feed shows a requirement of 2.66 hp-hr/lb mole oxygen in the product. Actual separation efficiencies are on the order of 5 to 15% (compared to reversible separation which is 100% efficient) and decrease as the oxygen content of the product stream decreases. Practical considerations for an efficient distillation column are pointed out and the Linde double column is studied in considerable detail, particularly in regard to the maximum amount of extra atmospheric pressure air which may be provided to utilize the reflux available in the upper portion of this column. The entire analysis which is based primarily on the Ponchon-Savarit method for the calculation of a distillation column required vapor-liquid equilibrium data and new enthalpy concentration charts, the data for which are presented.

C. Von Fredersdorff

Crawford, D. B. ELLIOTT OXYGEN PROCESS AND IMPURITY REMOVAL SYSTEM. *Chem. Eng. Progress* 46, 74-78 (1950) *February.*

The Elliott oxygen process is designed to overcome certain difficulties associated with other processes of this kind, particularly in distillation column flexibility and continuity of impurity removal. A flow diagram and technical description is given, of which the main point of interest is the novel method of removal of water vapor, carbon dioxide and acetylene in twin "clean-up" recuperative heat exchangers operating cyclically. The process incorporates a single column operating at 18 psig with provision for a variable nitrogen reflux for flexibility in capacity and oxygen concentration of the product, yielding gaseous oxygen of 95 to 99.5% purity after heat exchange with process nitrogen. Typical temperature distributions in the heat exchangers are presented.

C. Von Fredersdorff

Roberts, I. ECONOMICS OF TONNAGE OXYGEN PRODUCTION. *Chem. Eng. Progress* 46, 79-88 (1950) *February.*

A cost of $10.50 per ton of 95% purity oxygen is estimated for a 120 ton/day oxygen plant employing the Elliott cycle, using unit costs of 0.4 cents/hp-hr for power, 40 cents/M lb steam and fixed charges of 25% of investment cost. The Elliott cycle comprises an air purification system in which air is cooled at low pressure to approximately its dew point; a series of 4 indirect tubular heat exchangers for air cleanup before entering the single distillation column; means for producing a high pressure nitrogen stream which is divided into one portion entering an expansion engine for refrigeration, and another entering the distillation column as reflux; and a series of two indirect heat exchangers from which the oxygen and nitrogen products are obtained in gaseous form at approximately room temperature. Detailed performance and cost estimates for the component parts of the plant are given in terms of the respective operating variables. Important graphical representations include: (a) moles of reflux required per mole of oxygen product vs. the number of theoretical plates in the distillation column for various total percentages of oxygen recovered from the air; (b) optimum number of theoretical plates required for various percentages of oxygen recovery; and (c) optimum cost of oxygen recovery. From results of the calculations it is estimated that the optimum oxygen recovery is 99% of the oxygen present in air and that the optimum oxygen concentration of the product should be approximately 95% mol %. A set of cost curves for various size plants indicates a marked decrease in the oxygen cost with increasing plant capacity, with one particular result showing $5.40/ton for a 1000 ton day oxygen unit.

C. Von Fredersdorff

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Controls

Hoge, A. W., Hornaday, G. F. and Walls, C. O., Jr. MEASUREMENT AND CONTROL PROBLEMS IN TYPICAL FIXED-BED CATALYTIC PROCESSES. *Instruments* 23, 132-135, 174, 176, 178 (1950) *February.*

The principal features of a Houdry fixed bed catalytic process are described. One item described is a cycle timer with 900 contact points, which permits successive operations at intervals as short as 1 1/3 seconds. Other items which are discussed are large size, quick opening, motor operated valves for high temperature and pressure and turbo-compressor units which operate 24 hrs per day for months at a time.

W. J. Merwin

THE REFINER'S NOTEBOOK—MODES OF CONTROL. *Oil Gas J.* 48, 103 (1950) *March* 9.

The basic concepts of two position, proportional and proportional plus reset types of control are briefly discussed.

W. J. Merwin

Cooling Tower

Frazier, H. D. and Blohm, C. L. CHEMICAL DETERIORATION OF COOLING-TOWER LUMBER. *Oil Gas J.* 48, 72-75 (1950) *March* 16.

The chemical deterioration of wood in cooling water towers is discussed, based on a survey of over 500 units. Sodium carbonate in the water appears to have a very deleterious action and control of pH is recommended. Excessive chlorine is also considered to be undesirable. Wood damage is largely a matter of lignin removal, leaving cellulose behind in a weak form.

J. D. Parent

Todd, R. CONVERSION OF ATMOSPHERIC COOLING TOWER. *Petroleum Engr.* 22C, 26, 28-29 (1950) *February.*

In order to obtain greater cooling capacity of an atmospheric cooling tower, the most economical solution was found to be conversion of the tower to an induced draft type. The details of the method in which this was done are presented. This was done at a cost of $58,000 per a 29 bay tower.

W. J. Merwin

Plant Cost

Sherwood, R. W. EFFECT OF PLANT PROCESS SIZE ON CAPITAL COST. *Oil Gas J.* 48, 81, 83-84, 95 (1950) *March* 9.

The author shows that the relationship between costs of plants of various sizes is expressed by this relationship: (cost of plant of size A) = (cost of plant of size B) $(A/B)^x$ where x is between 0.58 and 0.82 and has an average value of 0.7. In the case of plants for high pressure or for smaller size plants the exponential value is smaller.

W. J. Merwin

Pressure Vessels

Lonngren, H. E. PRESSURE VESSEL CONSIDERATIONS — FLANGED AND DISHED HEADS. *Petroleum Refiner* 29, 147-149 (1950) *February.*

A graph is presented showing the relationship between the shell and head thicknesses of pressure vessels which are proportioned to give shells and heads of equal strength.

W. J. Merwin

PRESSURE-VESSEL DYNAMITE. *Operating Engr.* 3, 40-41 (1950) *March.*

The author recommends that the following items be placed on pressure vessels or on lines leading to them: pressure gauge, pressure reducing valve, safety valve, and vacuum breaker.

W. J. Merwin

12. MATERIALS OF CONSTRUCTION

Corrosion

Lain, G. D. WHAT YOU SHOULD KNOW ABOUT CORROSION OF FERROUS METALS. *Steel* 126, 101-102, 104 (1950) *March* 13.

Corrosion may be classified under the following environmental conditions: (1) atmospheric, (2) bacterial, (3) chemical, (4) high temperature oxidation, (5) soil, (6) stray current electrolysis, and (7) underwater. Conditions leading to a reversal of the normally protective zinc-steel galvanic couple are discussed.

B. E. Hunt

Peifer, N. P. CORROSION AND ITS CAUSES. *Am. Gas Assoc. Monthly* 32, 48-50, 58 (1950) *February.*

Various types of corrosion encountered with buried structures are discussed.

B. E. Hunt

Gas Turbines

Duckworth, W. H. and Campbell, I. E. THE OUTLOOK FOR CERAMICS IN GAS TURBINES. *Mech. Eng.* 72, 128-130, 144 (1950) *February.*

Rapid developments in ceramic technology in recent years point to the increasing use of refractory, non-ferrous material in gas turbine construction. Although much remains to be done, considerable industrial research has centered on the development of metal oxide refractory bodies and fired ceramic coatings. Spalling and oxidation resistant metal-ceramic combinations as well as pure ceramic materials (metallic oxides of magnesia, alumina and zirconia) are of considerable interest in possible improvements in design and in increasing the operating temperature of the gas turbine rotor, stator and combustion chamber. Further consideration is given to raw material selection, and forming, heat treating and brittleness properties of glass-free refractory materials. For a thorough evaluation of future ceramic materials a close cooperation between ceramist and gas-turbine engineer is recommended.

C. Von Fredersdorff

The following article, the abstract for which appears in the page indicated, is also called to your attention:

Van Rysselberghe, P., McGee, J. M., Gropp, A. H., Williams, R. D. and Delahay, P. POLAROGRAPHIC STUDY OF CORROSION PHENOMENA. p. 71

13. NEW BOOKS

Vacuum Technique

Guthrie, A. and Wakerling, R. K. VACUUM EQUIPMENT AND TECHNIQUES. New York, McGraw-Hill Book Co., 1949.

The requirements of the Manhattan Project and its successor, the Atomic Energy Commission necessitated the application of high vacuum techniques to both large scale engineering processes and laboratory operations to an extent never before attempted. The present volume is a survey of the subject, based largely on work carried out at the University of California. General principles are surveyed, with especial emphasis on the flow of gases at low pressures. This is followed by a discussion of the theory of vacuum practice, based on the method of dynamic analogs. A detailed consideration of the components of the vacuum system is followed by a chapter on vacuum gauges. The chapter on vacuum materials includes such topics as welds, gaskets, packing glands, methods of achieving motion within a vacuum system, valves, etc. Leak detection includes such diverse techniques as the halide torch and a simplified form of the mass spectrometer leak detector as constructed at the University of California. A lengthy series of appendices lists miscellaneous formulae and properties of materials used in vacuum practice. The book is extremely readable, and the approach to various topics is balanced and realistic.

S. Katz

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